24. Storage Tanks

24.1 General Description

Storage tanks, collecting tanks and other miscellaneous storage equipment not mentioned elsewhere have been grouped within the Storage Tank Area for permitting purposes. Numerous storage, mixing, and collecting tanks, as noted in Tables 24-1 through 24-5, are positioned throughout the manufacturing facility. These activities and equipment are considered to be insignificant sources of air emissions and are listed on Section R forms. Emissions estimates are only shown for Group 7 tanks which are significant.

24.2 Emission Source/Unit Identification

The following list gives the emission units within the Storage Tank area of Bowater's Catawba facility. The list also assigns a number for each emission unit. This number is the Equipment ID Number for the emission unit. The Equipment ID Number is not the number of any individual piece of equipment in the mill. Rather, it is the number assigned to all pieces of equipment associated with a given emission unit.

Area of Mill	Emission Unit	Equipment ID Number
Miscellaneous	Storage Tanks	1100

The purpose of this emission unit is to support other mill operations.

24.3 Emission Calculations

24.3.1 Allowable Emissions

SC Regulation 61-62.1 - Definitions, Permit Requirements, and Emissions Inventory
Section II - Permit Requirements
Emission Limitation: none

SC Regulation 61-62.6 - Control of Fugitive Particulate Matter
Emission Limitation: none

SC Regulation 61-62.7 - Good Engineering Practice Stack Height
Emission Limitation: none

40 CFR 60 Subpart Kb - Standards of Performance for Volatile Organic Liquid Storage Vessels

Storage Tanks Subject to 40 CFR 60 Kb:

Fuel Oil Tank (M10-276)
Kerosene Tank (M10-328)
Kerosene Tank (M10-329)
Kerosene Tank (M10-330)
Methanol Tank (M28-223)
High Density Pulp Chest (M44-180)
TMP Turpentine "A" Tank (M44-440)
TMP Turpentine "B" Tank (M44-488)
High Density Pulp Chest (M60-076)
Medium Density Pulp Chest (M61-228)
Low Density Pulp Chest (M61-232)

Emission Limitation: none

24.3.2 Actual Emissions

Emissions from this area consist primarily of volatile organic compounds (VOCs). The VOCs may potentially be in the form of hazardous air pollutants (HAPs) or South Carolina toxic air pollutants (South Carolina air toxics, or TAPs).

The following table summarizes the emission estimates for each element of the emission unit. Supporting calculations and explanations are found below. All tables feferenced below are located at the end of this section.

Emission Estimates for the Miscellaneous – Storage Tanks

Source	PM (tons/yr)	VOCs (tons/yr)	HAPs/SC air toxics (tons/yr)
From Storage Tanks	-	269	265

There are a number of storage tanks located throughout the facility. The tanks can be grouped into the following two categories and eight groups:

Category I: Tanks that are considered insignificant

These tanks meet one of the three following DHEC insignificant activities criteria:

a. Tanks meet the description given in DHEC's Insignificant and Activities List Pt. A
b. Tanks meet the description given in DHEC's Insignificant and Activities List Pt. B
c. Tanks have emissions less than 5 TPY of criteria pollutants and less than 0.5 TPY of South Carolina air toxics

Group 1. Tanks that are described by the South Carolina Insignificant Activities List Part A (see Table 24-1)

Group 2. Tanks that are retired, not in use, or not in service (emissions are effectively zero) (see Table 24-2)

Group 3. Tanks that are not vented (emissions are effectively zero) (see Table 24-3)

Group 4. Tanks that are described by the South Carolina Insignificant Activities List Part B (see Table 24-4)

Group 5. Tanks emitting <5 TPY of a criteria pollutant and <0.5 TPY of a South Carolina air toxic (Emissions calculated using AP-42 equations - detailed calculations follow) (see Table 24-5)

Category II: Tanks that are not considered insignificant

Emissions from these tanks were estimated using engineering judgment or emission factors provided by NCASI and/or AP-42. The emission estimates are included either in the Util./Misc. - Other Operations emission unit or in the emission unit to which the tank is associated (see Group 6, below).

Group 6. Tanks that are an integral part of the emission unit to which they are associated (emissions included in emission estimates for the respective emission unit) (see Table 24-6)

Group 7. Tanks emitting >5 TPY of a criteria pollutant or >0.5 TPY of a South Carolina air toxic (see Table 24-7)

Group 8. Tanks that are vented inside buildings (emissions accounted for in previously mentioned emission units – see Section 22 - Emissions From Buildings) (see Table 24-8)

Emissions from the tanks in Groups 1-4 are not estimated because it is expected that emissions are minimal. Emissions from the tanks in Group 5 were estimated using AP-42 equations, but the emissions were found to be less than 5 tons/yr of VOCs and 0.5 tons/yr of South Carolina air toxics.

Emissions from the tanks in Group 6 are assumed to be accounted for in the emission estimations for the other emission units throughout the mill because the tanks are integral parts of the process.

Emissions from the tanks in Group 7 were estimated using NCASI emission factors or AP-42 equations, and the emissions were found to be more than 5 tons/yr of VOCS and/or more than 0.5 tons/yr of a South Carolina Toxic. These emissions are considered part of the Util./Misc. - Other Operations emission unit.

Emissions from the tanks in Group 8 are assumed to be accounted for in the emission estimations for the VOC emissions from buildings throughout the facility.

In summary, significant emissions (>5 TPY criteria & >0.5 TPY SC Toxic) from storage tanks are included in the Util./Misc. - Other Operations emission unit and primarily occur from Group 7 storage tanks. The emission estimates are as follows:

Type of Tank	Pollutant(s) Emitted	Emission Rate (TPY)
Black Liquor / Soap	VOCs and HAPs	44
Stock	VOCs and HAPs	174
Green Liquor	VOCs and HAPs	5
Gasoline	VOCs and HAPs	28
Methanol	VOCs and HAPs	4
Condensate	VOCs	14
	HAPS	10
TOTALS	**VOCs**	**269**
	HAPs	**265**

The emission estimates given above for tanks are expected to be overly conservative and are assumed to account for all non-exempt, non-insignificant tanks located throughout the facility.

Emission estimates from tanks in Groups 5 and 7 were based on (i) the emission factor equations given in AP-42 (5th ed.) and (ii) NCASI emission factors. The following brief

narrative discussions provide the primary assumptions and methodologies used in each of the above estimation techniques:

(i) AP-42 Emission Factor Equations

The following assumptions were made in using the AP-42 emission factor equations:

1. The maximum liquid height (Hlx) is equal to about 80% of the tank shell height;
2. The tank shell radius (Rs) is equal to half the tank diameter;
3. The tank cone roof slope (Sr) is equal to 0.0625 ft/ft, as recommended by AP-42;
4. The breather vent pressure setting range (dPb) is equal to 0.06 psi, as recommended by AP-42;
5. The daily vapor pressure range (dPv) is equal to 1 psi;
6. The daily ambient temperature range (dTa) is equal to 27 R, after a review of Table 7.1-6 in AP-42;
7. The daily total solar insolation factor (I) is equal to 2,000 Btu/ft^2/day, after a review of Table 7.1-6 in AP-42;
8. The tank paint solar absorptance (alpha) is equal to 0.17, as recommended by AP-42;
9. The daily average ambient temperature (Taa) is equal to 80^{o}F;
10. The liquid height (Hl) is equal to about 80% of the tank shell height;
11. The working loss product factor (Kp) is equal to 1, as recommended by AP-42;
12. The tank shell height is equal to 150% of the tank diameter; and
13. For purposes of conservatively estimating emissions, the tank is assumed to experience 1 turnover per day (365 per year), such that the annual net throughput (Q) is readily obtained from the tank volume.

$$Q = 365 \times V / 42$$

where Q = annual net throughput, bbl/yr
365 = turnovers/yr
V = tank volume, gal
42 = conversion factor (42 gal/bbl)

As a result of these assumptions, the input values required for execution of the AP-42 emission factor equations reduce to the following:

V = tank volume, gal
Mv = vapor molecular weight, lb/lbmol
Pva = vapor pressure, psia

Values for Mv and Pva for the materials listed in Tables 24-5 and 24-7 were obtained from the following sources:

Material	Vapor Molecular Weight, Mv (lb/lbmol)	Vapor Pressure, Pva (psia)	Source
Fuel Oil	190	0.000 09	AP-42, 5th ed. p. 7.1-83 (assume properties of Residual Oil No. 6)
Kerosene	130	0.015	AP-42, 5th ed. p. 7.1-83 (assume properties of Jet Kerosene)
Caustic	40	0.000 01	EPA Document 560/4-88-002, 12/87, p. B-11 (assume properties of sodium hydroxide)
Sulfuric Acid	98.08	0.2	EPA Document 560/4-88-002, 12/87, p. B-12
Turpentine	136	0.2	CRC Handbook of Chemistry and Physics, 65th ed., p. D-210 (assume properties of α-pinene)
Defoamer	18	0.77	CRC Handbook of Chemistry and Physics, 65th ed., p. D-198 (assume properties of water)
Coolant	18	0.77	CRC Handbook of Chemistry and Physics, 65th ed., p. D-198 (assume properties of water)
Hydrazine	32.05	0.28	EPA Document 560/4-88-002, 12/87, p. B-10
White Liquor	40	0.000 01	EPA Document 560/4-88-002, 12/87, p. B-11 (assume properties of sodium hydroxide)
Polymer	18	0.77	CRC Handbook of Chemistry and Physics, 65th ed., p. D-198 (assume properties of water)
Coagulant	18	0.77	CRC Handbook of Chemistry and Physics, 65th ed., p. D-198 (assume properties of water)
Flocculant	18	0.77	CRC Handbook of Chemistry and Physics, 65th ed., p. D-198 (assume properties of water)
Treated Wastewater	18	0.77	CRC Handbook of Chemistry and Physics, 65th ed., p. D-198 (assume properties of water)
Shower Water	18	0.77	CRC Handbook of Chemistry and Physics, 65th ed., p. D-198 (assume properties of water)
Gasoline	62	9.9	AP-42, 5th ed. p. 7.1-83
Hydraulic Oil	190	0.000 09	AP-42, 5th ed. p. 7.1-83 (assume properties of Residual Oil No. 6)
Lube Oil	190	0.000 09	AP-42, 5th ed. p. 7.1-83 (assume properties of Residual Oil No. 6)
Methanol	32.04	2.61	AP-42, 5th ed., p. 7.1-85
Alum	n/a (% volatiles essentially zero)	n/a (% volatiles essentially zero)	Hawley's Condensed Chemical Dictionary, 12th ed., p. 41
Sodium Hydro sulfide	n/a (% volatiles essentially zero)	n/a (% volatiles essentially zero)	Hawley's Condensed Chemical Dictionary, 12th ed., p. 1058
Sodium Chlorate	n/a (% volatiles essentially zero)	n/a (% volatiles essentially zero)	Hawley's Condensed Chemical Dictionary, 12th ed., p. 1052
Clay	n/a (% volatiles essentially zero)	n/a (% volatiles essentially zero)	Hawley's Condensed Chemical Dictionary, 12th ed., p. 288
Hydrogen Peroxide	n/a (% volatiles essentially zero)	n/a (% volatiles essentially zero)	Hawley's Condensed Chemical Dictionary, 12th ed., p. 616-7
Borol	n/a (% volatiles essentially zero)	n/a (% volatiles essentially zero)	Hawley's Condensed Chemical Dictionary, 12th ed., p. 161 (approximate borol ≈ boral)
Sodium Silicate	n/a (% volatiles essentially zero)	n/a (% volatiles essentially zero)	Hawley's Condensed Chemical Dictionary, 12th ed., p. 1068-9

(ii) NCASI Emission Factors

Emission factors for black liquor tanks, pulp storage tanks, and condensate tanks were reported as follows:

Type of Tank	VOC Emission Factor	HAP Emission Factor	Source
Black Liquor	0.59 lb C/hr/tank	assume all VOCs are HAPs	NCASI technical bulletin 701, 10/95, p. 110
Soap	assume emission factor for Black Liquor tank applies	assume all VOCs are HAPs	see source for Black Liquor tanks
Green Liquor	assume emission factor for Black Liquor tank applies	assume all VOCs are HAPs	see source for Black Liquor tanks
Pulp/Stock	0.86 lb C/hr/tank	assume all VOCs are HAPs	NCASI technical bulletin 701, 10/95, p. 120
Condensate	0.034 lb/ton (assume 800,000 tons/yr, yielding 3.105 lb C/hr/tank)	0.024 lb/ton (assume 800,000 tons/yr, yielding 2.192 lb/hr/tank)	NCASI technical presentation handout